GASEOUS EXCHANGE MARKING SCHEME

1. 1992 Q11 P1

a) Identity- Gill

M- Gill arch/bar

N- Gill raker

P- Gill filament

b) i) Numerous to increase surface area

ii) Thin(membrane/walled structure)

iii) Rich/dense network of blood supply;for efficient gaseous exchange

rich of blood

2. 1994 Q14 P1

- Both are moist
- Both have thin lining/epithelium
- Both are richly supplied with blood capillaries/dense network of blood vessels/highly vascularized

3. 1996 Q14 P1

a) CO_2 diffuses into tracheoles follows the trachea; not through spiracles

b) Stomata pores / stomata; cuticle

Acc. Lenticels.

4. 1998 Q4 P1

To facilitate transportation of gases/ Exchange of gases; if gases are mentioned (both must be O_2 and CO_2)

5. 1999 Q5 P1

Shelter Food, Oxygen Removal of CO_2 breeding sites.

6. 1999 Q16 P1

a) Muscles of diaphragm contract; causing the diaphragm to flatten (from dome position. The external intercostals muscles contract internal intercostals muscles relax pulling the ribcage upward/forward and outward in man.

These movements increases the volume of the thoracic cavity; reducing the pressure; of the thoracic cavity; compared to atmospheric pressure; this causes the atmospheric air to rush into the lungs.

(Through the nostrils, trachea bronchioles and alveoli).

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b) **Theory- photosynthesis**

Guard cells have chloroplasts; in the presence of light; photosynthesis occurs in guard cells, producing sugar in guard cells; osmotic pressure increases/osmotic potential lowers; water from neighbouring /adjacent cells enter into guard cells; causing turgidity of guard cells; causing turgidity of guard cells.

Theory 1.

Guard cells have chloroplasts; in the presence of light photosynthesis occur in the guard cells of stomata; producing in the guard cells; osmotic pressure increases/lowers osmotic potential water from the neighbouring /adjacent cells, enter into guard cells; causing turgidity of guard cells .
The inner walls of the guard cells are thicker than outer walls; so during turgidity the inner walls stretch more; causing the guard cells to bulge outward; stomata opens.

Theory 2.

Guard cells have chloroplasts (Day) in light; photosynthesis occurs in the leaf/guard cells lowering the CO_2 concentrations; this increases PH/alkalinity which triggers of enzymatic conversion of starch to sugar (glucose); leading to low osmotic potential/ increased osmotic pressure in guard cells; guard cells absorb water from epidermal cells; thus becoming turgid; the inner walls are thicker than the outer walls; outer walls stench more than inner walls; causing guard cells to bulge outwards, stomata opens;

In the absence of light (night); no photosynthesis; CO_2 concentration increases due to respiration; PH lowered/ acidity increases; sugar converted to starch; osmotic pressure lowered/ osmotic potential increases; guard cells lose water to adjacent epidermal cell becoming flaccid; stomata close.
Day low H+ high PH opens stomata.

Starch glucose.

Theory 3
Guard cells have chloroplasts; in light AT produced; the energy drives K+ irons from adjacent epidermal cells into guard cells; accumulation of K+ raises osmotic pressure (lower osmotic potential) of guard cells; guard cells absorbs water from adjacent epidermal cells; becoming

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turgid; the inner walls are thicker than the outer walls so outer walls stretch more than inner walls causing guard cells to bulge outward.

Stomata opens.

In the absence of light (night) ATP rapidly decreases; no energy of potassium +ions pump ion; migrate by diffusion from guard cells to adjacent epidermal cells; become flaccid; the thinner outer walls of guard cells shrink (OWWTE; thicker inner walls reduces their curvature/OWTTE; thus closing the stomata.

7. 2000 Q11c P1

(c) Broad/ flat leaf (lamina) to provide large surface area or absorption of
gases
Thickness: allow gases to pass though fast
Presence of stomata for efficient diffusion of gases
Presence of air spaces for easy defuses

8. 2001 Q10 P1

– Mesophyll cells/ spongy mesophyll/ palisade mesophyll/ stomata/ substomatal chambers; lenticels; cuticles.

9. 2002 Q9 P1

Stomata, lenticels: (reject cuticle)

10. 2003 Q13 P1

a) i) Oxygen
ii) Carbon dioxide
b) Oxyhaemoglobin
c) i) The blood plasma except blood cells and proteins; that has filtered out of the capillaries.
ii) It is a medium of exchange of substances/ materials between capillaries and body cells; supply nutrients to cells
/ supply oxygen to cells / remove waste products from cells.
d) i) Hepatic portal vein
ii) Pulmonary artery

11. 2004 Q3 P1

a) W – (thoracic) Vertebrae;
Y – Sternum/sternabra(e)
Z – Intercostals muscle;(external /intercostals muscle

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b) Has air spaces; which store gases for gaseous exchange buoyancy;

Acc. Floating.

12. 2005 Q18 P1

Gaseous exchange in terrestrial plants.

Gaseous exchange in plants involves two main respiratory gases: carbon IV oxide and oxygen.

During daytime green plants take in carbon IV oxide for photosynthesis and oxygen for respiration. During photosynthesis oxygen is given out as a by product and released to the atmosphere. In plants such as the flowering plants stomata in the leaves and lenticels in the woody stems and pneumatophores/breathing roots in aquatic woody plants provide the surface for gaseous exchange. Gaseous exchange taken place by diffusion across the respiratory surface.

Stomata

These are located mainly in the leaves and in younger parts of the stem. The opening and closing of stomata is controlled. Mainly by the intensity of light. They are normally open during the day and closed during the night. Several theories explaining the mechanism of stomata opening and closing have been put forward.

Photosynthetic theory

Guard cells have chloroplasts. During daylight, they carry out photosynthesis producing surges. The surges increase the osmotic pressure of the cell sap. This causes water to more into guard cells from the neighbouring epidermal cells by osmosis.

The results is an expansion and increase in turgidity of the guard cells causing the stomata to open.

In darkness photosynthesis stops. The sugar in the guard cells is converted to starch. This lowers the osmotic pressure of guard cells causing the to lose water to neighboring cells by osmosis.

The guard cells become flaccid and the stomata close.

The guard cells become flaccid and the stomata close.

Starch – sugar interconversion:

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The enzymatic conversion of starch to sugar proceeds more readily in an alkaline environment(high PH).The conversion of sugar to starch occurs more readily in an acidic environment (low Ph).During the night, when photosynthesis is not taking place, carbon dioxide accumulates in leaf cells it combines with water to form carbonic acid. This lower the PH in the guard cells leading to conversion of sugar to starch this decreases the osmotic pressure in the guard cells causing them to lose water to the neighboring epidermal cells. The guard cells become flaccid and the stomata close.

During daylight, when photosynthesis is taking places, the concentration of carbon dioxide in the leaf cells, raising their PH, and favouring the conversion of starch to sugar. This increases the osmotic pressure in the guard cells causing them to take in is an expansion and increase in turgidity of the guard cells causing the stomata to open.

Potassium Ion (K+) mechanism

When guard cells are exposed to light, their chloroplasts manufacture ATP. The ATP drives at K+ pump in the cell membrane of the guard cells. This causes an active uptake of K+ into the guard cells from surrounding epidermal cells.

Accumulation of K+ in guard cells increases the osmotic pressure of their cell sap. This causes water to move into the guard cells from neighbouring epidermal cells by osmosis. The result is an expansion and increase in turgidity of the guard cells causing the stomata to open.

-At the onset of darkness, chloroplast stop making ATP and its concentration in guard cells falls rapidly stopping K+ pump, K+ migrate from the guard cells
Causing them to lose water to the neighbouring cells by osmosis. The guard cells become flaccid and the stomata close.
-Water molecules are pumped into the guard cells from adjacent epidermis cells.
-A small extent of gaseous exchange takes place in the stem through structures called lenticels.
These are small gaps in the bark usually circular or oval & slightly raked on the bark surface.
The cells in these area are thin walled and loosely packed leaving air space which communicates with air spaces in the cortex. Hence 0_2 for respiration is taken up & $C0_2$ is given out.

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13. 2006 Q5 P1

- Stomata found on upper epidermis to allow efficient gaseous exchange
- Presence of large air spaces/Aerenchyma tissues to enable it float/Bouyant/
- Storage of air
- Absence of cuticle to enhance gaseous exchange.

14. 2007 Q12 P1

(a) - Pneumatophores
- Aerenchyma tissues
- Cuticle

b) The diaphragm flattens.
Volume in thoracic cavity increase.
Pressure decreases compared to atmospheric pressure. Air rushes into the lungs through the nostrils.

15. 2007 Q1 P2

(a) K- Pleural membranes L- Alveolus
M- Intercostal muscles

(b) Has c- shaped cartilage rings that support it preventing it from collapsing and allow free flow of air
- Inner lining has secreting cells that trap fine dust particles and micro- organisms
- Inner lining has hair like structures called cilia that enhance upward movement of the mucus to the larynx

(a) Diffusion

(d) Mycobacterium tuberculosis

16. 2008 Q8 P2

(a) Highly vascularized/ network of blood capillaries L.S.A (for G.E)
Thin membrane/ epithelium/ one cell thick wall/ thin lining; rej thin walls moist lining

(b) **Breathing in**

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External intercostals muscles contract; internal, intercostals muscles relax lifting/ raising the ribcage upwards and outwards; muscles of diaphragm contract. It flattens the volume of the thoracic cavity increases; pressure decrease; higher air pressure in the atmosphere forces air into the lungs

Breathing out

External intercostals/ muscles relax; internal intercostals muscles contract moving the ribcage downwards and inwards; the muscles of diaphragm relax, the diaphragm assumes dome shape; volume of thoracic cavity decreases; while pressure increases; higher pressure forces air out of the lungs

17. 2009 Q16 P1

(a) Tracheole; / *Rej: trachea / Tracheole system*

(b) Moist for gases to dissolve (in solution); Branched / ramify Numerous tubes to increase surface area (for gaseous exchange)

18. 2011 Q19a P1

a) (i) Skin; (ii) buccal cavity

19. 2011 Q22 P1

- Air that enters lungs has a higher content of oxygen than air that leaves the lungs;
-Air that enters the lungs has lower content of carbon (IV) oxide than air that leaves the lungs;
(2marks)

20. 2011 Q3a, b P2

(a) Name the causative agents for the following respiratory diseases.
(2marks)

i) Whooping cough
Bordetella partussis;
ii) Pneumonia
Streptococcus pneumoniae;

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(b) Describe how oxygen in the alveolus reaches the red blood cells.
(4marks)

Inhaled oxygen dissolves in moisture in the alveolus; since the oxygen concentration in blood is lower than in the alveolus; oxygen diffuse; through the alveolus epithelium, the capillary wall into the plasma, and finally into the red blood cells;

21. 2012 Q6 P1

(a) F Branchiole

G Intercostal muscles/external intercostal muscles;
Rej internal intercostal muscles

(b). H (Pleural membranes) secretes/encloses pleural fluid to lubricate/protects lungs;

J (Diaphragm) separates chest cavity from abdominal cavity/work to effect volume/
Pressure changes in chest cavity for inhalation and exhalation/ventilation;

22. 2012 Q5 P2

(a) The external intercostals muscles contract while the internal intercostals muscles relax;the ribcage is pulled upwards and outwards;the diaphragm muscles contract and
the diaphragm flattens; the volume of thoracic cavity/lung increases/the pressure in the thoracic cavity/lung decreases; air rushes into the lungs; from the atmosphere through the nose.

(b) The osmotic pressure of guard cells increase when sugar is manufactured
during photosynthesis/starch is converted to sugar in low acidity/potassium ions move into guard cells during the day; water enters guard cells from the surrounding cells by osmosis; because the guard cells are bean shaped with thin outer walls and thick inner walls; the thin outer walls expand more as the cell becomes turgid; thus the thick inner walls curve causing the stomata to open

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